AGRICULTURAL Research

July 1961

HONOR AWARDS 1961

UNITED STATES DEPARTMENT OF AGRICULTURE

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Contents

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Anniversary

This year marks the 50th anniversary of the first appropriation by Congress for research in fertilizer technology. Responsibility for this work was assigned in 1911 to the USDA.

Fifty years ago, farmers were often more impressed by the dark color and powerful odor of fertilizer than by plant nutrient content. Today, however, fertilizer value determinations are more scientific. Chemical materials, manufactured under skilled technical supervision and carefully controlled conditions, now comprise the major portion of our fertilizer.

The first Federal appropriation for fertilizer research was used to survey possible sources within the U.S. of natural fertilizers. Growth and accomplishments of USDA work in this field during the past half century have strongly influenced development of U.S. fertilizer production.

World War I spurred research on fixation of atmospheric nitrogen. A pioneer experimental unit for synthesis of ammonia from air was built by USDA. Followup studies are credited with establishment of our synthetic ammonia industry, which today is the largest in the world. USDA personnel participated in commercial application of the process.

Other laboratory and pilot-plant operations led to manufacture of phosphoric acid by the furnace method. Extensive studies were made also on superphosphate ammoniation, composition and properties of phosphate rock, and other phases of phosphate technology.

Granular fertilizer mixtures having superior qualities for easier handling, storage, and field application have come from research on improving grade and physical condition of constituent materials.

Recent work includes studies of trace-nutrient materials, and behavior of pesticides and other agricultural chemicals in mixtures with fertilizers. USDA initiated preparation and distribution of radioactive fertilizers for use in research. They are contributing new knowledge and understanding of complex soil-plant-nutrient relationships. These and other studies now being conducted promise to make still more efficient the use of fertilizers in crop production.

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Growth Through Agricultural Progress

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

ARS employees received 2 of the 7 distinguished service medals and 18 of 99 superior service medals given recently in annual recognition of the USDA workers who are named outstanding

■ USDA employees have received 1961 Honor Awards for their outstanding contributions to research and administration programs.

Secretary Freeman presented six distinguished service medals, ninety-three superior service medals, one 50-year service award, and sixty-two 40-year awards.

Following these Washington presentations, one distinguished service award and six superior service awards were presented to work units at their field headquarters. Forty-year service awards were presented to 104 field-service employees.

ARS Distinguished Service Awards:

A. W. LINDQUIST, *Entomology Research Division*, for original research and forceful leadership in improving the health and welfare of man and livestock through development of new methods for controlling insects of medical and veterinary importance.

SCREWWORM ERADICATION FIELD STATION, *Animal Disease Eradication Division*, for an outstanding contribution in developing methods and procedures for successful eradication of the screwworm in the Southeast, thus saving the livestock industry millions of dollars a year.

ARS Superior Service Awards:

Crops Research Division: H. L. CRANE, for notable research and leadership in directing horticultural studies of tree-nut crops.

A. A. HANSON, for pioneering research in grass cytogenetics and breeding, and for outstanding leadership in research that contributed significantly to the development of 14 improved grass varieties and hybrids.

F. L. TIMMONS, for unusual leadership in research on control of aquatic and ditchbank weeds in drainage and irrigation systems, and in coordinating weed research in the West.

G. A. WIEBE, for research leadership and achievements of great benefit to barley producers and processors, which have brought national and international recognition to USDA.

Eastern Utilization Research and Development Division: C. A. ZITTLE, for excellence in basic research on the chemistry of milk, particularly interactions among proteins and other components of milk related to stability of milk concentrates.

Entomology Research Division: B. A. PORTER, for national leadership and outstanding administration of research leading to improved control of insects and mites injurious to fruits and vegetables.

WESTERN INSECTS AFFECTING MAN AND ANIMALS INVESTIGATIONS UNIT, for complex research leading to the development of the first safe, effective, and practical systemic insecticide to control cattle grubs.

Farm Economics Research Division: M. D. HARRIS, for outstanding leadership in Federal, State, and regional research on land tenure, and

HONOR AWARDS 1961

(Continued)

A. W. Lindquist was honored for his research leadership in development of new insect-controlling methods.

for initiating interdisciplinary studies in law and economics, which contributed to greatly improved tenure policies and practices.

Household Economics Research Division: JANET MURRAY, for superior research and leadership in development and application of statistical methods for collection, analysis, and interpretation of data on food consumption and dietary levels.

Meat Inspection Division: R. H. PHILBECK, for exceptional initiative, competence, and knowledge in establishing a program to determine the safety and acceptability of plastic and synthetic film materials used by the meat industry.

Northern Utilization Research and Development Division: H. M. TEETER, for creative and distinctive contributions to research by chemical modification of vegetable oils to produce new products that should increase utilization of fats and oils.

Plant Pest Control Division: L. F. CURL, for promoting effective international understanding, cooperation, and leadership in plant protection in Mexico, thereby benefiting U.S. agriculture.

Plant Quarantine Division: W. W. CHAPMAN, for exceptional ability in administering the Federal plant quarantine program at the Nation's largest port of entry, New York City.

H. S. DEAN, for outstanding skill in public administration and in national and international relations, demonstrated by effective coordination of USDA's agricultural quarantine activities with other border-crossing controls.

Soil and Water Conservation Research Division: L. V. WILCOX, for scientific services directed toward protecting irrigated land in the West from hazards of boron toxicity and saline water, and making friends for the U.S. in other countries.

Southern Utilization Research and Development Division: J. N. GRANT and R. S. ORR, a joint award for development and application of methods and instruments for measuring significant properties of mechanically and chemically treated cotton fibers.

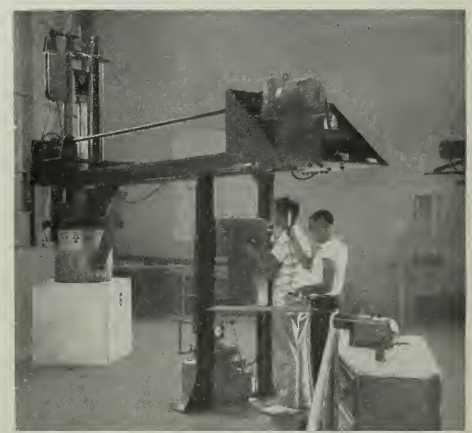
State Experiment Stations Division: E. R. MCGOVRAN, for meritorious leadership in planning, coordination, and administration of entomology research between State agricultural experiment stations and USDA.

Western Utilization Research and Development Division: BELT-TROUGH DRYER DEVELOPMENT GROUP, for inventing a radically new technique for continuous drying of heat-sensitive fruits and vegetables in piece form, and for developing commercial-scale equipment for applying the method.

H. C. BERGER, ARS meat inspector at Opelousas, La., led in length of service, with 50 years in USDA.☆

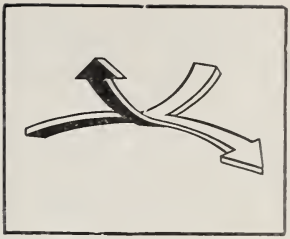
Modified airplane hangar at Sebring, Fla., houses the Screwworm Laboratory honored for the development of methods to eradicate this livestock pest.

This cobalt unit sterilized screwworm pupae at Sebring.



Generally more efficient is an apt description of clear-span design that is strong, though appearing weak

Improved Roof for Farm Buildings



Hyperbolic-paraboloid roof is shaped in two opposing curves for strength.

■ Thin, gracefully curved roofs may soon top many farm structures. Though appearing too delicate to withstand a hard rain, they are actually stronger, more useful, and likely cheaper to build than most conventional beam-and-rafter roofs.

The new clear-span roof structures need fewer supporting members than conventional ones. More headroom is available because rafters are eliminated. And the structures may be built faster, more economically.

The lighter roofs derive their strength from mutually supporting arches incorporated into their structure. The arches cross at right angles. One arch curves up, the other down.

These hyperbolic-paraboloid roofs have already been used for some large structures, such as convention halls. The principle has also been applied in recent years to the design of experimental farm structures.

In 1958, ARS agricultural engineers built a small (16 feet square) turkey shade which has four roof sections of four test materials—plaster, aluminum, plywood, and waterproofed insulation board. Each material is in good condition after three winters at USDA's Agricultural Research Center, Beltsville, Md.

Experimental turkey shade, built in 1958, has withstood three winters—is still in good condition. A new building roof, of similar design, is under construction.

The same principle is being used in the roof for a 16 x 24-foot building. Two sections are made of ¼-inch hardboard strips 24 inches wide. The third section's strips are of the same material, 12 inches wide. The fourth section is made of ⅜-inch plywood in strips 24 inches wide.

Three weather coatings are being tested on different sections of the roof—an epoxied vinyl, a fibrous asphalt emulsion, and a polyester. This research is being conducted by R. C. Liu, N. C. Teter, and T. E. Kent.

Liu gages snow load on test roof section. It survived the severe 1960–61 winter.

Will the roof withstand heavy loads? It should. The researchers loaded sandbags on an experimental roof section made of ¼-inch-thick tempered hardboard. The section withstood pressures of 30 pounds per square foot—equivalent to about 3 feet of snow accumulation.

The hyperbolic-paraboloid principle has been applied to man-made structures only in the last decade. This principle is derived from nature. The tent caterpillar's nest is given strength by being curved in two directions. The new roofs utilize the same principle.☆

DOUBLE ADVANCE IN CITRUS RESEARCH

Speedup in indexing of disease-free budwood, and a fast way of identifying a disease, are significant gains

At least 10 citrus viruses cause loss of vigor or death of trees, and reduce yield and quality of fruit. Diseased groves mean lower income to producers and higher prices to consumers of citrus products.

Most infected trees show no outward symptoms for long periods—and then only when infected scions are grafted to sensitive rootstocks. This has made selection of virus-free budwood difficult, and slowed efforts to control or eliminate viruses.

Two new research breakthroughs promise to remove this time lag and help speed citrus improvement.

Quick Test for Exocortis Virus

■ A simple 4-minute chemical test, which detects exocortis virus infection in citrus trees, is helping to speed certification of virus-free budwood in Florida.

The new microscopic test reveals effects of exocortis virus in bark tissue of sensitive rootstocks 12 to 18 months after they are grafted with infected budwood. Until now, the disease could be diagnosed only by external symptoms, which usually don't appear for 4 to 8 years after grafting. Trees indexed for budwood could not be certified free of exocortis for 8 years.

The new technique involves a color reaction between a laboratory chemical and certain compounds that form in the bark of infected trees. When thin sections of infected trifoliate orange bark are treated with phloroglucinol and hydrochloric acid, a red color develops in cells of the phloem rays (tissues that carry foods between bark and wood). No reaction occurs in phloem ray cells of exocortis-free bark. The test is not affected by the presence of other viruses.

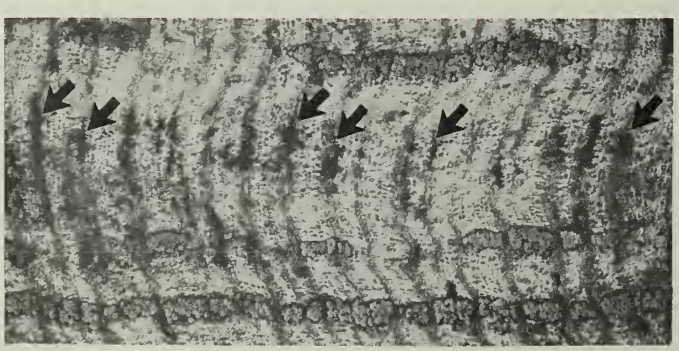
The test was developed by ARS plant pathologist J. F. L. Childs at USDA's Horticultural Field Laboratory, Orlando, Fla. He was assisted by biological aid J. L. Eichhorn of the laboratory and G. G. Norman of the Florida State Plant Board.

Childs says the color fades after 5 or 6 hours. To make a more permanent record, he stained duplicates of infected specimens with safranin and light-green dyes. This is too slow and complex for routine testing, but it is precise and provides a semipermanent record.

All citrus species are susceptible to exocortis, but most exhibit no external symptoms except stunting. Sensitive species (primarily trifoliate orange, some citranges, Rangpur lime, and sweet lime), grafted with infected buds, develop bark cracking and scaling.

These species are excellent rootstocks. Trifoliate orange, for example, resists tristeza virus, citrus nematode, Phytophthora foot rot, and cold. Grafted trees bear early and produce unusually fine fruit. Growers have made little use of sensitive rootstocks, however, because of widespread exocortis infection in commercial varieties and the long time required to find virus-free budwood.

Childs believes the new color test can help to increase use of these desirable rootstocks. In field studies, color-test results agreed 98.6 percent with visual diagnoses of exocortis in 215 old trees on trifoliate orange. It substantiated without error the known exocortis status of 41



Stained phloem ray cells (arrows) indicate exocortis virus infection in trifoliate bark.

Exocortis virus causes severe scaling of bark on sensitive rootstocks.

young nonscaling trifoliate trees, some of them infected experimentally.

Used on 204 symptomless trees in the Florida budwood indexing program, the test indicated that about half were infected with exocortis. Since these trees represent the healthiest and most productive ones in Florida, Childs estimates that more than half the State's commercial bearing trees are infected and can't be grown on sensitive rootstocks.

Exocortis is the first citrus virus infection diagnosed by a chemical test. But many other plant viruses are known to cause characteristic tissue changes that can be used in diagnosing infection. Childs is looking for such clues to other citrus viruses.☆

A Virus Transmitted Mechanically

■ First mechanical transmission of a citrus virus has recently been achieved in USDA and Florida Agricultural Experiment Station research.

ARS plant pathologist T. J. Grant and Florida virologist M. K. Corbett mechanically transmitted infectious variegation virus (in infected leaf juice) from Eureka lemon to sour orange and Duncan grapefruit and back again to Eureka lemon. Similar transmissions were made between citrus and noncitrus plants, including cowpeas, crotalaria, and cucumbers.

Before, the only known way to transmit a citrus virus was to graft infected buds or other tissue onto test plants and wait, sometimes several years, for symptoms. Mechanical transmission cuts this waiting time to a few weeks. It also provides a way to isolate and identify individual viruses, and to determine noncitrus hosts for diagnostic aids.

Failure of the previous attempts to transmit citrus viruses mechanically in leaf juice has usually been attributed to low concentration of virus in the inoculum, natural inhibitors in the foliage, or insusceptibility of the experimental plants.

Grant and Corbett credit their success to the addition of sucrose and activated charcoal to *immature* leaf juice in the inoculum, and to constant, cool air temperature during virus incubation in test plants.

The most effective inoculum was a mixture of 1 gram of juice from visibly infected young leaves, 1 milliliter of 20-percent sucrose solution, and $\frac{1}{10}$ gram of activated charcoal. It was frozen 22 hours at $-10°$ to $-20°$ C., then ground and thawed.

Inoculation was made by dusting test-plant leaves with 500-mesh Carborundum, rubbing with inoculum, then rinsing with water. Symptoms appeared 8 to 30 days later, depending on the plant and greenhouse temperature. Symptoms were most pronounced in plants held 2 weeks at about 20° C.

These studies indicate that infectious variegation is caused by more than one virus or virus strain. Inoculated plants held at fluctuating temperatures (20° to 35° C.) had symptoms of infectious variegation *or* psorosis (a disease complex that includes infectious variegation). But those kept constantly at about 20° C. produced *only* infectious variegation symptoms.

This may mean that the viruses multiply at different rates at different temperatures, or that psorosis symptoms are masked at the lower temperature.

The researchers are looking for hosts that differentiate between the viruses or strains of the infectious variegation-psorosis complex, so that the disease organisms can be studied singly and in combination.

They also are trying to develop inoculum mixtures that will transmit other citrus viruses mechanically.☆

Leaf symptoms (right) show cowpea is infectious variegation host.

Grapefruit inoculated with infected juice had twist and crinkle in new top leaves (left).

Vacuum drill takes soil samples for study of structure, water paths.

What We're Doing About...

SEDIMENTATIO

Ingenious instruments are being used in laboratory and field in efforts to learn what happens to eroded soil, and why

■ There's some fascinating research going on in Mississippi, aimed at giving us better ways of dealing with sedimentation.

Scientists at USDA's new Sedimentation Laboratory near Oxford are operating ingenious instruments in laboratory and field studies. They're trying to learn *what* happens to soil (and *why*) from the time it erodes and washes into streams until it becomes destructive sediment miles away (AGR. RES., September 1959, p. 8).

This information is needed to develop more effective ways to control sedimentation, which now costs the U.S. more than $200 million a year. It will help in designing techniques to hold soils in place and keep streams flowing efficiently and safely.

The Oxford facilities provide the first opportunity for ARS scientists to study sedimentation under combined laboratory and watershed conditions. The work is in cooperation with Mississippi State University and the University of Mississippi.

Laboratory director C. R. Miller says recent studies show there is no fixed relationship between water depth and rate of flow in many sandbed streams. At one time, a 5-foot-deep stream may be found to carry 800 cubic feet per second, and at another time as much as 1,600 cfs. This means the channel has much greater hydraulic efficiency at some times than at others. And there are indications that as hydraulic efficiency increases, transport of sediment increases also.

This discontinuous depth-flow relationship does not conform to widely used hydraulic laws. It had been observed by N. H. Brooks in laboratory flume studies at the California Institute of Technology. He attributed the discontinuity to variable hydraulic roughness associated with changes in shape of the channel bed. The Oxford field study substantiates this.

To learn more about this stream phenomenon, the ARS researchers have set up experiments in a 100-foot-long flume which has been built in the laboratory. An ultrasonic instrument—first of its kind—is being used to auto-

Underwater probe sends sound waves up and down, plots changing profiles of surface and sandbed in flume (left).

Gamma density probe measures volume-weight of sediment accumulation in reservoirs.

Neutron probe is lowered through access tube (left) to measure moisture in watershed soils.

Nuclear techniques being developed at Oxford are helping to trace eroded soil, follow movement of underground water, measure sediment buildup in reservoirs.

matically measure changing water depths in the flume. Continuous records of water depth above and below the instrument will provide data with which to calculate changing profiles of the water surface and the sandbed. The new instrument will also be used in watershed streams to obtain comparative field data.

Methods are being worked out for measuring *total* sediment load carried by a stream. Present equipment does not measure sediment near the bottom—estimated in some cases at 20 percent or more of the load. Total measurement will permit more reliable calculations of sediment transport and deposition.

The Oxford researchers are not limiting their studies to sediment after it gets into streams. They are going into the pastures and fields of the watershed to learn how and why sedimentation begins. A special rig, capable of drilling 100 feet into quicksand, is supplying soil samples for studies of soil strata and underground water paths. Soil density and soil moisture are being measured, with nuclear and electronic equipment, to determine how these are related to production and deposition of stream sediment. Short-lived radioactive isotopes are being used in the laboratory as tracers in studying water movement in soils.

Radioactive isotopes are also being studied for use in tracing individual soil particles as they move into and through watershed streams. A method has been devised for tagging single sand grains with scandium–46, which emits easily detected gamma rays. To try out the new method, the researchers placed 10 tagged grains on the soil surface in an area of State-owned land. Two of the grains were traced for 30 days as they moved 50 feet down slope. Half of the tagged particles have actually been recovered and returned to the laboratory.

This tracing of particles is perhaps the first attempt to establish a time schedule in the erosion process. The technique will assist in determining how fast and far eroded soils travel. Knowing this, engineers will be better able to devise ways of stopping sediment before it piles up in damaging proportions.

As progress continues on these and other phases of research at the Oxford laboratory, the scientists hope to find ways of treating watersheds for optimum conservation and use of soil and water.☆

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GROWTH CONTROL BY CYCLIC LIGHTING

Up to 95 percent reduction in electrical costs and use of many more plant species are the benefits

■ A new method of applying artificial light to plants to control their growth—*cyclic lighting*—can save nurserymen up to 95 percent of electrical costs—and increase the number of plant species that can be grown this way.

Cyclic lighting is the application of light in patterns of short, regularly occurring intervals during a 3- to 5-hour period in the middle of the night. Light applied in these cycles of alternating light and darkness can control plant growth with as little as a total of 12 minutes of light per night.

In contrast, the lighting system now used in most commercial greenhouses to get the same amount of plant-growth control uses 4 hours of continuous light per night.

The great reduction in lighting costs per plant controlled with cyclic lighting would permit nurserymen to regulate growth of more plant species such as crop plants, trees, and shrubs. Only plants with high unit value—chrysanthemums, for instance—are now controlled to bring them into maturity at set times of the year.

Cyclic lighting is a result of ARS research on photoperiodism—control of growth responses such as seed germination, vegetative growth, and flowering by the relative length of daily light and dark periods.

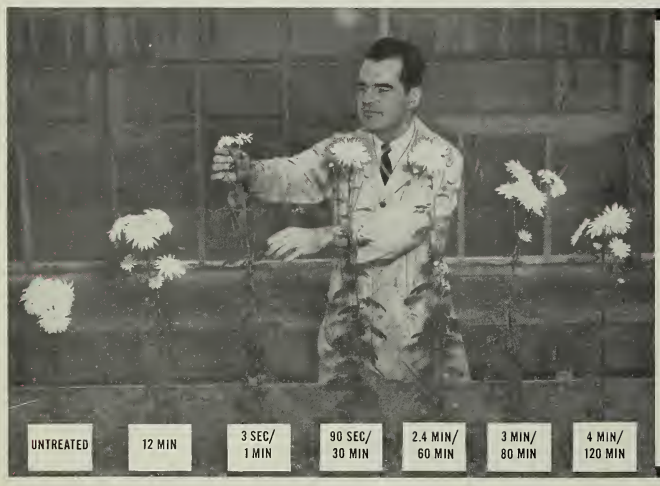
Regulation of day length has been used by nurserymen since the early 1930's to control flowering of chrysanthemums. At first, 8 hours of continuous light applied at the beginning or end of the day was used. Then, in the 1940's and 1950's, scientists found that 4 hours of continuous light applied during the *middle of the night* was just as effective.

During the middle of the night, plants apparently undergo crucial growth changes, according to scientists. Thus, by manipulating night-length artificially during this period, plant growth can be readily controlled. Cyclic lighting is used during this period.

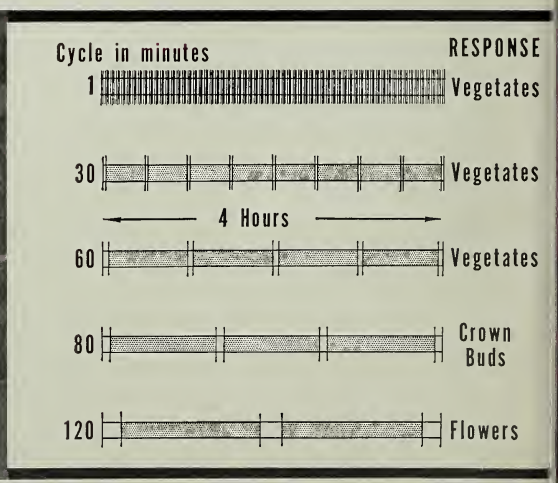
Phytochrome made development possible

Cyclic lighting's development was possible because of the reaction to darkness (*dark change reaction*) of phytochrome—the dual-form, light-sensitive pigment which governs growth in all plants. When the sun sets, or when artificial light is turned off, phytochrome in all plant tissue reacts by slowly changing its form. This form change triggers changes in plant growth.

Developers of cyclic lighting found that the pigment's change in form—in reaction to a dark period that follows a period of artificial light in the



H. M. Cathey demonstrates effects of cyclic lighting on mums. All of the treated plants received total of 12 minutes of light. Only cycles given to center three kept them vegetative until desired blooming time.



Graph shows results from study (left). Cycles were given during 4 hours in middle of night. Only those in which dark periods between light were less than 1 hour maintained growth control.

middle of the night—is complete enough in 1 hour to affect plant responses. In terms of control-growing, this would cause a loss in the attempted control of the plant.

Therefore, horticulturist H. M. Cathey and plant physiologist H. A. Borthwick regulated light intervals in the cycles so that intervening dark periods never exceeded 1 hour. They let phytochrome begin its reversion, but repeatedly interrupted darkness with a light break before the pigment changed enough to lose growth-controlling effectiveness.

For example, to control growth with a total of 12 minutes, Cathey and Borthwick used cycles such as: 3 seconds of light every minute for 4 hours, 30 seconds every 10 minutes for 4 hours, or 90 seconds every 30 minutes for 4 hours. Light was applied from 10 a.m. to 2 p.m. at 20-foot-candles (a 75-watt incandescent lamp 3 feet above the plant).

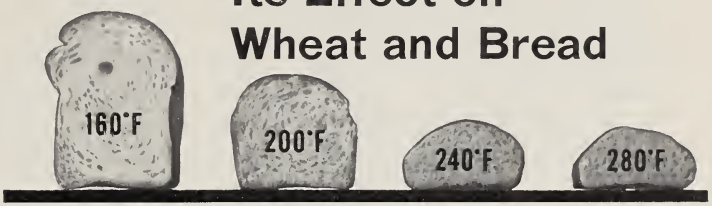
The scientists got equal control of growth responses using longer total light exposures at lower foot candles of intensity. But with all successful cycles, the amount of light needed for control of plants was still considerably less than the 4 hours used commercially. These experiments were made at USDA's Agricultural Research Center, Beltsville, Md.

Nursery conditions will determine setup

No specific recommendations are offered to nurserymen about programs of cyclic lighting best suited for their operations. What is best depends on the existing lighting installation, the plant species controlled, and the purpose for which the light is given.

Phytochrome and its sensitivity to light were first detected in plants in the early 1950's. The pigment was isolated from plant tissue in 1959 by scientists at Beltsville (AGR. RES., Nov. 1959, p. 3).☆

ARTIFICIAL DRYING:
Its Effect on Wheat and Bread



Drying 27-percent-moisture wheat at 160° F. did not harm bread loaf volume. Higher temperatures reduced loaf size.

■ Artificial grain drying, a boon to wheat growers when the weather is too wet during harvest, sometimes creates trouble for bread bakers.

Crop drying takes moisture out of wheat so it can be stored without spoilage, but may damage the grain's milling and baking qualities.

When the bakery industry complained about impaired baking properties in artificially dried wheat, USDA and Kansas research was undertaken to learn the relationship between initial moisture content of wheat and damaging drying temperatures.

Chemists K. F. Finney and R. C. Hoseney and technologists M. D. Shogren and L. C. Bolte of the ARS Hard Winter Wheat Quality Laboratory, and Kansas Agricultural Experiment Station agronomist E. G. Heyne conducted the research at Manhattan, Kans. They dried samples of incompletely ripened Pawnee hard red winter wheat in a laboratory convection oven at 10 temperatures, from 90° to 360° F.

Their research confirmed what farmers have observed: Wheat artificially dried at high temperatures looks plump and unshriveled. However, the scientists found that bushel weight of the grain was consistently reduced by drying temperatures of 120° or 160° F. and higher—depending upon initial grain moisture content.

The scientists explain that high temperatures cause the endosperm of the wheat kernel to swell and shatter, though the seedcoat does not rupture. The same action causes popcorn to pop.

Researchers also milled the dried wheat, mixed bread according to a standard formula, and baked trial loaves from each sample.

These loaves indicated which drying temperatures harm grain for baking. Drying temperatures at which the baking quality of wheat is damaged depend on the moisture in the grain when it is dried. Less heat is needed to damage high-moisture wheat. A higher temperature is tolerated without harm by wheat of lower initial moisture content.

For example, drying temperatures above 140° F. will harm the baking quality of 35-percent-moisture wheat. But wheat containing only 20 percent moisture can be dried at 180° F. without damage.

Loaf size and quality were not affected by grain drying temperatures up to 160° F. Higher temperatures reduced loaf volume. At each higher temperature, highest-moisture grain made the smallest loaves.☆

CALF WEIGHTS

STOCKING GUIDE FOR CATTLEMEN

A drop in weaning weights may indicate that rangeland is being overgrazed, even if the cows don't seem to be losing flesh

■ A decline in calf weaning weights may show that a cattleman's range is being overgrazed, even though cow weights do not change enough to indicate a shortage of forage.

This conclusion comes from a study of beef cattle stocking rates at USDA's Southern Plains Experimental Range near Woodward, Okla.

The conclusion is unusual because it's generally thought that cows reflect overgrazing better than their calves—a deteriorating range should lower a cow's weight before her suckling calf is affected.

But the Oklahoma study showed that calf weaning weights varied considerably, depending on the number of acres their dams were allowed to graze. One group was allowed 12 acres per cow. Another group grazed 17 acres per cow, and a third, 22 acres. These were 8-year averages. Actual acres per cow varied, depending on pasture condition.

Stocking rate had little effect on cows

Condition and weight of the cows remained relatively constant, regardless of the stocking rate. Had all of the cows been brought together in May each year, brand numbers would have been needed to identify cows in each group, according to ARS agronomist E. H. McIlvain and range conservationist M. C. Shoop.

But it was easy to relate calf weight and condition to stocking rates by June 1 each year—before grass could be injured from overgrazing.

Weaning weights averaged 404

pounds for calves from cows grazing on 12 acres each. Calves from the 17-acre cows weighed 481 pounds and those from cows grazing 22 acres each, 512 pounds.

Calf crop percentages were higher for cows allowed more than 12 acres. Cows on 17 acres averaged a 92 percent crop; those on 22 acres averaged 89 percent. On the 12 acres-per-cow pasture, fewer calves were produced—an 81 percent crop.

Pastures grazed at 12 acres per cow were severely weakened from overgrazing. Forage production was 912 pounds per acre, while yield from pastures supporting a cow every 22 acres averaged 1,102 pounds.

Use of gage requires certain conditions

McIlvain and Shoop think calf weaning weights can be used to help gage proper stocking under certain conditions. If this method is used, cattle should get all roughage from native range. Stock should get supplemental protein in winter and salt all year. Grazing intensity within a pasture should also be fairly uniform.

Calf weights won't be useful if much hay is fed regularly. And creep feeding the calves, of course, will keep their weights from indicating range condition.

In other areas, calf weights may not be the only sensitive indication of overgrazing. In an earlier USDA-Montana experiment, different stocking rates affected cow weights and calving percentages as well as calf weaning weights.☆

What Stimulates Chick Growth?

■ Why does fat or oil in a chick's diet stimulate growth? Scientists don't know. Some believe the boost in growth is caused by unidentified growth factors. Others don't. USDA researchers are conducting studies to answer the question.

At least one growth stimulant is believed to be present in the oily portion of egg yolk. To investigate chick growth responses to fat and oils, ARS poultry husbandmen Henry Menge and C. A. Denton are making chick nutrition studies at the Agricultural Research Center, Beltsville, Md.

Their experiments show that if dried egg yolk contains an unidentified growth factor, so does egg oil, corn oil, lard, soybean oil, and coconut oil.

Each of these—substituted for carbohydrates, calorie for calorie—in a high-energy diet boosted chick growth significantly. This was true for chicks on equalized intake rations and for those fed all the feed they wanted.

Birds were fed the diets from hatching to 4 or 8 weeks of age. Protein and energy levels were the same in fat-substituted diets and in check rations. Diets containing 22 or 32 percent protein gave similar results—oils substituted for carbohydrates stimulated growth.

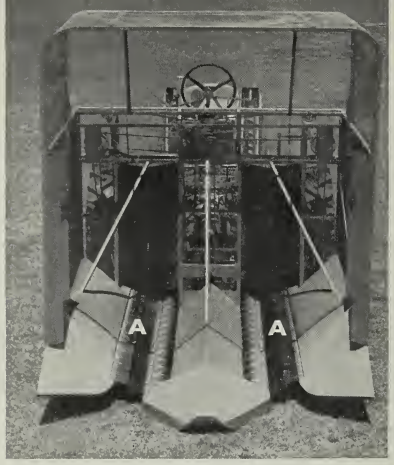
All the oils boosted growth equally well. To determine, however, if unsaturated fatty acids are involved in promoting growth, the scientists fed chicks hydrogenated coconut oil. This has an iodine value of 0.26—indicating a very high degree of saturation. In contrast, lard has an iodine value of 65.9; soybean oil, 128.7. (High iodine values indicate low degrees of saturation.)

Hydrogenated coconut oil didn't stimulate growth. This suggests that unsaturated fatty acids may be involved, or that the stimulant in coconut oil is inactivated by hydrogenation.

Much basic study will be required before scientists can tell if the growth promoting ability in animal and vegetable oils can be explained, and the active materials identified and used to better advantage. Further experiments along this line are now underway.☆

HARVESTER AIDS CASTOR BEAN STUDIES

In less than 2 minutes, three men and the machine can harvest two rows, each 20 feet long—and there is less loss due to shattering



As machine harvests two rows, plants pass between brushes (A). Beans are removed from plants by beater under device.

■ A machine to harvest castor beans grown on experimental plots has been developed by USDA scientists.

Use of this two-row device permits much faster harvesting than by hand, the usual procedure. Faster harvesting results in less loss of beans from shattering.

The harvester was developed by L. G. Schoenleber, ARS agricultural engineer, working in cooperation with the Oklahoma Agricultural Experiment Station at Stillwater. The machine is mounted on the rear of a small tractor, which is reversed to drive backwards. The driver's seat and the controls are also reversed.

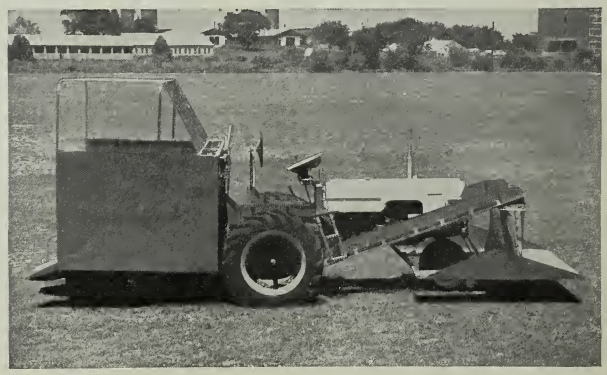
This enables the operator to look directly down upon the header, which removes beans from the plants. Augers convey the beans to sacking attachments, and a worker sacks the beans, labels the bags, and stacks them on a platform-trailer.

The machine will harvest a plot two rows wide and 20 feet long in about 1½ minutes. Hand-harvesting requires about ¾ man-hour per plot, plus additional supervisory help.

Besides saving labor, the device gives researchers a good indication of whether new varieties being developed will be suitable for machine harvest on a commercial basis.☆

Controls of tractor are reversed to give driver view of operation. Augers convey beans back to sacking device. Worker labels and stacks filled bags on the platform.

Machine harvests two rows 20 feet long in about 1½ minutes, if two men work on sacking platform.



Disinfectant is needed in washer

Harmful bacteria on clothing and household fabrics can stay alive for weeks and even survive home laundering, recent Institute of Home Economics studies indicate.

This hazard to family health can be reduced, USDA researchers believe, by adding an effective disinfectant to the wash water.

Some of today's fabrics maintain a better appearance if warm water is used in laundering them. And most home washers now include a warm (about 100° F.) water cycle. Even the *hot* water used in home laundering averages only 120° to 130° F.

These temperatures are too low for bactericidal action. Washing contaminated clothing or household fabrics at such temperatures cannot control the spread of harmful bacteria as well as older methods, which included boiling.

In experiments using cotton, wool, and acetate fabrics, ARS textile bac-

teriologists Ethel McNeil and Maurice Greenstein studied survival of three types of bacteria. The scientists used *Staphylococcus aureus*, which may cause carbuncles, kidney infections, and pneumonia; *Escherichia coli*, the common intestinal bacterium; and *Mycobacterium butyricum*, a bacterium similar to the one that causes tuberculosis.

The textile bacteriologists found that all three types of bacteria lived through warm-water laundering. The number of surviving bacteria varied with the fabric and the type of micro-organism.

Few or none of the bacteria stayed alive, however, when either of two disinfectants was added to the wash water. One was a phenolic compound and the other a quaternary compound. Both of the disinfectants destroyed more than 95 percent of the micro-organisms on the fabric tested. These disinfectants are becoming available, under various retail trade names, to consumers.

The tests were part of an ARS study to learn more about the ability of bacteria to survive on household fabrics. The scientists also want to determine better ways of controlling the spread of disease by these materials.

Six cottons for breeding studies

Four new cottons with high fiber strength and two insect-starving nectariless cottons are available to State agricultural experiment stations and commercial firms for use in breeding research.

The high-fiber-strength cottons, Atlas 63, Atlas 92, Atlas 182, and Atlas 302, are medium staple. In preliminary tests, they appear to have yield potentials equal to the leading commercial varieties now grown in the Southeast. The Atlas breeding stocks were developed at the Coastal Plain Experiment Station, Tifton, Ga., by agronomist J. G. Jenkins and coworkers of the station, in cooperation with USDA scientists.

The insect-starving cottons, SR–1 and RN 293, bear fewer nectaries than upland cottons and as a result attract fewer destructive insects (AGR. RES., November 1960, p. 3). These cottons are valuable for developing commercial nectariless varieties, but further breeding work is required to remove undesirable traits such as small boll size and short staples. Progress has already been made in improving the selections.

SR–1 was developed in research headed by ARS geneticist J. R. Meyer in cooperative work at Mississippi's Delta Branch Experiment Station, Stoneville. RN 293 was developed at

Brownsville, Tex., by ARS geneticist C. L. Rhyne and associates. They worked in cooperation with the Texas and North Carolina Agricultural Experiment Stations.

Stocks of Atlas are available from the Coastal Plain Experiment Station, Tifton, Ga. Stocks of SR–1 may be obtained from the Delta Branch Experiment Station, Stoneville, Miss. Stocks of RN 293 are available from the Pink Bollworm Research Laboratory, Brownsville, Tex., or the Department of Agronomy, Texas Agricultural Experiment Station, College Station, Tex.

ARS scientist elected to Academy

H. A. Borthwick, ARS plant physiologist, was recently elected to membership in the National Academy of Sciences. This is the Nation's top scientific society.

Borthwick was instrumental in the discovery and separation from plants (in 1959) of the vital, light-sensitive pigment *phytochrome*. It is the key to growth changes in all plants. He was one of the first to specifically relate morphological, anatomical, and

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H. A. Borthwick, ARS plant physiologist, named to top science society.

physiological happenings in plants to the light stimulus.

Since 1948, Borthwick has headed ARS research on the influence of light on plants. He was appointed chief scientist of USDA's Plant Physiology Pioneering Research Laboratory, when it was established in 1959 to investigate light as an environmental influence on plant life.

Borthwick is the second USDA scientist to become a member of the Academy. S. B. Hendricks, leader of ARS pioneering research on mineral nutrition of plants, was elected to the Academy in 1952. Hendricks was also a key figure in the research leading to the discovery of *phytochrome*. Borthwick and Hendricks are stationed at the Agricultural Research Center, Beltsville, Md.

The National Academy of Sciences was chartered by Congress in 1863 for the promotion of science. Membership is limited to 550 leading U.S. scientists and 53 foreign associates.

Borthwick has received the Charles Reid Barnes Life Membership Award (1960); the Department's Distinguished Service Award (1959); and, with ARS plant physiologist R. J. Downs, the Leonard H. Vaughan Award (1957). He was president of the American Society of Plant Physiologists and the Washington Botanical Society.

Secretary of Agriculture Freeman, during recent tour of Agricultural Research Center, Beltsville, Md., heard about studies on use of plant growth regulators. From left are: H. M. Cathey, ARS horticulturist; Secretary Freeman; F. P. Cullinan, assistant director of ARS crops research; E. C. Betts, Jr., USDA personnel director; W. G. Kubicek, University of Minnesota; F. J. Welch, assistant secretary of USDA; and L. P. McCann, ARS foreign research and technical programs division.

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